AeroSafe

The Aeronautical Newsletter of the

Seattle Flight Standards District Office

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PRACTICAL DENSITY ALTITUDE

In the last issue we introduced you to Practical Density Altitude, thoughts from Kurt Anderson, NTSB accident investigator. With twenty years of aircraft accident investigation experience, Kurt has interviewed many pilots who have succumbed to misconceptions regarding flights in Density Altitude situations. He has identified Ten Deadly Sins, misconceptions that lead directly to light airplane accidents.

If you remember, Deadly Sin Number 1 was "Not knowing that Best Rate of Climb Speed (indicated) decreases as much as 5 to 8 knots as Density Altitude increases". In response to that article we received a letter from reader Philip Mack.

Dear Wilbur:
Several years ago, I was returning to Seattle from Winnemucca, NV in my Cessna 152. I was given a clearance to takeoff on runway 20. The elevation of the airfield is 4,303 feet and the temperature was about 80 degrees F. There is a 7,449 foot peak straight out from the runway about 6 or 7 miles away. Since I would be turning to the northwest after takeoff, this didn't seem to be a factor.

At full gross weight, I lifted off as usual and planned to continue on runway heading until I could gain enough altitude and airspeed to make my turn. When I got out of ground effect, however, I did not climb very much at all! I was scooting out over the sage brush, barely climbing, and heading for the obstacle that now seemed to be a lot closer than I had originally thought. Pucker Time! I checked the mixture control and confirmed that it was adjusted properly. I couldn't afford to lose any lift by banking. For a sickening moment it looked like I was doomed to either fly into the hill or land on the open grazing land covered with sage brush and whatever rocks or other impediments were hidden from view. The latter was the preferred choice, but I was still flying.

As gently as I could, I raised the nose to see if I could get any climb out of it. There was no buffet. I raised the nose some more. At this point I wasn't looking at airspeed, I was flying by feel. Slowly I began to gain altitude. It seemed terribly slow, but after a while, I felt it was safe to attempt a shallow banked turn to the right. It worked!

I had about 5,000 hours total time and had flown many different type aircraft – military and civilian. I was now a private pilot but had been trained in the Army Air Force during WWII and had been a professional pilot for many years after that War. My first 60 hours of flying were completed without an airspeed indicator as a matter of standard practice. But this experience taking off from Winnemucca was not like any I ever had before – or since. After that flight I checked my flight manual and the correct airspeed for the conditions was 63 KIAS not the 70 that I was using!!! The article in AeroSafe was very appropriate.
Phil

Dear Phil:
Thanks. Well said. Read on.
Wilbur

Now we bring you Density Altitude Deadly Sin Number 2:

When departing from airports in a general aviation airplane at less than maximum gross weight due to Density Altitude considerations, **DO NOT CLIMB AT YOUR MAXIMUM GROSS WEIGHT, BEST RATE OF CLIMB SPEED!** It seems that a great number of pilots memorize only one Best Rate of Climb Speed – the one for maximum gross weight at sea level. In truth, Best Rate of Climb Speed (indi-

cated) decreases as gross weight decreases. Depending upon which airplane you fly and how far below max gross weight you are operating, Best Rate of Climb Speed (indicated) can drop as much as 10 knots or more (check your Pilot's Operating Handbook)! Attempting to climb at your max gross weight Best Rate of Climb Speed in a lightly loaded airplane, can take climb performance which is poor at best and make it downright lousy.

If you attempt to climb out of a high Density Altitude airport at a reduced gross weight while using your sea level, maximum gross weight Best Rate of Climb Speed (indicated), you combine Sin 1 with Sin 2. The result can easily be that you are attempting to climb at a speed that is 15 knots too fast! Such a mistake can turn minimal climb performance into negative climb performance!! **This deadly combination is precisely what is leading to our most common Density Altitude accidents!!!**

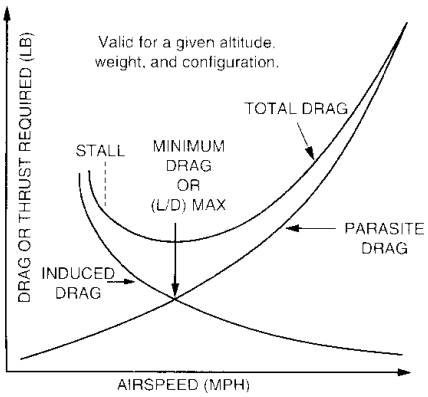
Which brings us to Deadly Sin Number 3, A lack of understanding of the significance of true airspeed and it's affect on turn diameter.

At Sea Level on a Standard day, if we ignore calibrated and equivalent airspeeds, an indicated airspeed of 150 knots results in a true airspeed of about 150 knots. But at 8,000 feet MSL on a 95 degree Fahrenheit day, an indicated airspeed of 150 knots results in a true airspeed of 180 knots. Big deal, 30 knots.

If we use a bank angle of 45 degrees, the formula for *radius* of turn is, "Velocity squared divided by 11.26. At a true airspeed of 150 knots, the math works out to 1,998 feet (we're going to call it 2,000 feet). At a true air speed of 180 knots, the math works out to 3,240 feet (we're going to call it 3,250 feet). All right, so that's an additional 1,250 feet. But that's an additional 1,250 feet of *radius*. To make the famous 180 degree turn out of a valley where you are unable to out climb the terrain, you need to know the turn *diameter*. At the same indicated (150 knots) the 8,000 foot, 95 degree day turn diameter requires 2,500 feet **more** than the Sea Level, Standard day turn. **That's an additional half mile due to the fact that the true airspeed is 30 knots higher than indicated!** The 180 degree turn requires 4,000 feet at 150 knots. At 180 knots it requires 6,500 feet**. That's an increase of 61 per cent!**

This is all complicated by the fact that we all have a pretty good mental picture of just how much room is required to make a 180 degree turn. After all, the turn from downwind to final is a 180 turn. And when we're on downwind we all know how far to space ourselves from the runway. But, if you fly up the Density Altitude Canyon and delay your escape turn until the cliff on the far side of the valley is about the same distance as the distance from Sea Level downwind to final (at 150 knots), there is a good chance you'll smash into the cliff about 61 percent of the way through the turn. As alarming as that sounds, it is happening far too often.

The fix? A lot of pilots think they can reduce the radius of that turn by slowing the airplane down. Slowing the airspeed reduces the radius. Well, yes. But there is a trap if you slow it down to the extreme. Keep in mind your Density Altitude Induced Power Requirement for slow speed flight.



The drawing shows a Lift over Drag curve for a very typical light general aviation airplane. Notice how the induced drag and total drag curves spiral upwards as you move left of the "Minimum Drag or (L/D) Max" point. As airspeed slows below the minimum drag point, drag increases RAPIDLY. Now, take a really close look at the title of the vertical line that defines the left side of the graph. It is titled "Drag or THRUST REQUIRED (LBS). Once you slow below the "Minimum Drag or (L/D) point, thrust required is increasing just as RAPIDLY as is drag.

Remember the situation: you are attempting to do a 180 degree course reversal within the confines of a high density altitude canyon. The slower you go, the more thrust required if you are going to maintain altitude during the turn. But just how much excess horsepower do you think you have in a high density altitude situation? You can prove it to yourself. Fly your favorite airplane to 8,000 feet or more.

Make sure you are NOT in a canyon. The hotter the day, the better. Now, slow down. Slow way down. Slow to the point the stall warning horn is honking. Lower half flaps. Now roll into your 45 degree bank angle "Escape Turn" and try to maintain altitude. We'll bet if you're flying behind a non-turbo charged piston engine, you don't have enough excess horsepower to do it.

In real life, too many pilots are attempting this turn and descending into the canyon walls.

Our advice? Make the turn long before the canyon becomes confined. Make the turn early enough that a shallow bank is all that's necessary to complete the turn. Better yet, STAY OUT OF THOSE CANYONS. The only time you'll see your AeroSafe staff maneuvering within the confines of a canyon is shortly before landing at an airport located within the canyon, or shortly after taking off from an airport located within the canyon. Other than that, you'll see us flying over the canyon, but never through it.

We know it's winter and this is probably the wrong time to be talking about Density Altitude scenarios, but next summer, ya'll be careful, please.

Thanks Kurt.

CFI AND MAINTENANCE TECHNICIAN OF THE YEAR

Last call for nominations for the year 2000 CFI and Maintenance Technician of the Year for Western Washington. The winners will be awarded trophies at the Northwest Aviation Conference in February and will be entered in the Regional and possibly National competitions.

Nomination packages must include an essay of no more than 1,000 words, and can include such items as a resume of the persons' accomplishments and contributions to the industry, letters of recommendation, commendations and recognition's, awards earned, and supporting documentation such as magazine and newspaper articles.

Nominations must reach Scott Gardiner at the Seattle FSDO (address at the head of this newsletter) no later than November 14, 2000. Hurry!

ICING ON THE CAKE

This is our annual reminder that the combination of moist air moving west to east over the Pacific Ocean, and the uplifting affect of the Cascade Mountains can produce the best (or worst, depending upon your perspective) aircraft icing conditions in the World. This virtual Ice Machine over the Cascades can produce ice so fast that light, general aviation aircraft not equipped with de-icing equipment can be literally forced out of the sky. Our Air Traffic Controllers are aware of and are sensitive to your needs regarding ice avoidance, BUT THEY CANNOT SEE ICING CONDITIONS COMING. If ATC gives you a clearance that you think will lead you into icing conditions, NEGOTIATE! It might be inconvenient for ATC, but it will save Search and Rescue a lot of work.

Sometimes we wonder if you don't get tired of reading this story, so we have left most of the details out. If you want all the details, see the November/December issue of AeroSafe for the past couple of years. Those issues are available at: www.faa.gov/fsdo/seafsdo/

ICING VIDEO

NASA has produced a video on the subject of Icing. The video provides the very latest findings regarding the formation of ice on aircraft. The video is wonderful and every IFR pilot should have a copy in their video library. We have one copy of the video here in the FSDO. The video is NOT available on loan. However, if you would like a copy of it, send a 2 hour VHS video tape to Scott Gardiner at the address on page 1. Scott will copy the icing video onto yours and return it to you.

NORTHWEST AVIATION CONFERENCE

The Conference is set for the Puyallup Fairgrounds, February 24 and 25. Complete details will appear in the next issue of AeroSafe.

ADDRESS CHANGE?

The address list is stored in a BIG computer at the Home Office in Oklahoma City. They are the ones to notify of any address changes so we can continue to bring you AeroSafe and other good stuff.

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Box 25082
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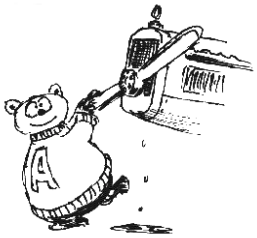
AEROSAFE

A Bearly Able



Publication